VOLUMETRIC VIRTUAL REALITY KEYBOARD METHODS, USER INTERFACE, AND INTERACTIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to, and is a continuation of, U.S. Provisional Patent Application No. 62/334,034, filed on May 10, 2016, entitled "VOLUMETRIC VIRTUAL REALITY KEYBOARD METHODS, USER INTERFACE, AND INTERACTIONS", the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

This description generally relates to input methods and devices in virtual reality (VR) environments.

BACKGROUND

Many virtual reality environments accept user input from a wide range of input devices. For example, any combination of mobile devices, keyboards, controllers, and tracked hand movements can be used to provide input to a virtual reality (VR) space. Providing input in the VR space can also entail a combination of motions and device manipulations. Each motion and device manipulation can be performed by a user accessing the VR space.

SUMMARY

A system of one or more computers can be configured to perform particular operations or actions by virtue of having software, firmware, hardware, or a combination of them installed on the system that in operation causes or cause the system to perform the actions. One or more computer programs can be configured to perform particular operations or actions by virtue of including instructions that, when executed by data processing apparatus, cause the apparatus to perform the actions.

One general aspect includes a computer-implemented method that includes generating a virtual environment for display in a head-mounted display device. The virtual environment may include at least one three-dimensional virtual object having a plurality of volumetric zones configured to receive virtual contact. The method may also include detecting, with a processor, a plurality of inputs corresponding to a plurality of actions performed in the virtual environment on the at least one three-dimensional virtual object. Each action may correspond to a plurality of positions and orientations associated with at least one tracked input device. The method may also include generating, with the processor, and for each action and while detecting the plurality of inputs, a plurality of prediction models. The plurality of prediction models may determine in which of the plurality of volumetric zones, the at least one tracked input device is predicted to virtually collide. The method may also include for each action, matching, with the processor, at least one prediction model from the plurality of prediction models to a trajectory corresponding to a virtual collision with at least one of the plurality of volumetric zones. The method may further include in response to matching the at least one prediction model, performing the action associated with the at least one prediction model, and providing output in a display of the head-mounted display device. The output may include a textual character corresponding to the virtual collision in the at least one of the plurality of volumetric zones. Other embodiments of this aspect include corresponding computer systems, apparatus, and computer programs recorded on one or more computer storage devices, each configured to perform the actions of the methods.

Implementations may include one or more of the following features. The method where determining which of the plurality of volumetric zones a portion of the at least one tracked input device contacts is based at least in part on the plurality of positions and orientations associated with the at least one tracked input device and a derived velocity for the at least one tracked input device. The method where the plurality of prediction models process six dimensions of spacial data for a determined course of travel corresponding to the tracked input device and one or more of the plurality of volumetric zones. The method where generating the plurality of prediction models includes processing the plurality of inputs that include, for each action, a heading, an angle, a course, and a derived velocity. The method where the course includes a trajectory and a collision zone corresponding to at least one of the plurality of volumetric zones. The method further including in response to determining a match does not exist between the at least one prediction model and the trajectory, suppressing performance of the action associated with the at least one prediction model. In some implementations, the method includes generating, with the processor, and for each action and while detecting the plurality of inputs, a plurality of prediction models and determining based on the plurality of prediction models in which of the plurality of volumetric zones the at least one tracked input device is predicted to virtually collide. The method further including suppressing performance of the action associated with the at least one prediction model based on determining that a force of a velocity associated with the action is below a threshold velocity. The method where the plurality of prediction models filter one or more of the plurality of actions to determine which of the plurality of actions corresponds to entering text on a virtual keyboard associated with the at least one three-dimensional virtual object. The method where the virtual environment includes at least one configurable text entry device and the input corresponds to entries performed on the configurable text entry device. The method where the configurable text entry device includes an electronic virtual keyboard ergonomically adaptable to a user accessing the virtual environment. The method where the plurality of actions are tracked in six degrees of freedom to determine a position and orientation associated with each action performed within the virtual environment. The method where the at least one tracked input device is a set of two virtual reality controllers depicted in the virtual environment as a set of two drumsticks. The method where the at least one tracked input device is a virtual object held by a hand of a user accessing the virtual environment. Implementations of the described techniques may include hardware, a method or process, or computer software on a computer-accessible medium.

The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a user accessing a virtual reality (VR) space to perform interactive tasks.